Preliminary Classification:

  Proposed Class:

  Subclass:

NOTE: *"All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example 'Proposed Class 2, subclass 129.'" M.P.E.P. § 601, 7th ed.*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of

Inventor(s):   Juha KALLIOKULJU,   Matti TURUNEN,   Jan SUUMAKI

WARNING: *37 C.F.R. § 1.41(a)(1) points out:*

    "(a) A patent is applied for in the name or names of the actual inventor or inventors.

    "(1) The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.63, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(i) is filed supplying or changing the name or names of the inventor or inventors."

For (title):   METHOD AND ARRANGEMENT FOR AVOIDING LOSS OF ERROR-CRITICAL
                NON REAL TIME DATA DURING CERTAIN HANDOVERS

CERTIFICATION UNDER 37 C.F.R. § 1.10*
(Express Mail label number is mandatory.)
(Express Mail certification is optional.)

I hereby certify that this New Application Transmittal and the documents referred to as attached therein are being deposited with the United States Postal Service on this date _November 22, 1999_, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number _EL336861481US_, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Deborah J. Clark

(type or print name of person mailing paper)

Signature of person mailing paper

WARNING: *Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.*

*WARNING: *Each paper or fee filed by "Express Mail" **must** have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. § 1.10(b).*
        *"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will **not** be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.*

1. Type of Application

This new application is for a(n)

(check one applicable item below)

☒ Original (nonprovisional)

☐ Design

  ☐ Plant

WARNING: Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. § 371(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.

WARNING: Do not use this transmittal for the filing of a provisional application.

NOTE: If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.

☐ Divisional.

☐ Continuation.

☐ Continuation-in-part (C-I-P).

2. Benefit of Prior U.S. Application(s) (35 U.S.C. §§ 119(e), 120, or 121)

NOTE: A nonprovisional application may claim an invention disclosed in one or more prior filed copending nonprovisional applications or copending international applications designating the United States of America. In order for a nonprovisional application to claim the benefit of a prior filed copending nonprovisional application or copending international application designating the United States of America, each prior application must name as an inventor at least one inventor named in the later filed nonprovisional application and disclose the named inventor's invention claimed in at least one claim of the later filed nonprovisional application in the manner provided by the first paragraph of 35 U.S.C. § 112. Each prior application must also be:

  (i) An international application entitled to a filing date in accordance with PCT Article 11 and designating the United States of America; or

  (ii) Complete as set forth in § 1.51(b); or

  (iii) Entitled to a filing date as set forth in § 1.53(b) or § 1.53(d) and include the basic filing fee set forth in § 1.16; or

  (iv) Entitled to a filing date as set forth in § 1.53(b) and have paid therein the processing and retention fee set forth in § 1.21(l) within the time period set forth in § 1.53(f).

37 C.F.R. § 1.78(a)(1).

NOTE: If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICA-TION(S) CLAIMED.

WARNING: If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. §§ 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. §§ 120, 121 or 365(c). (35 U.S.C. § 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. §§ 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

☐ The new application being transmitted claims the benefit of prior U.S. application(s). Enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

3. Papers Enclosed

A. Required for filing date under 37 C.F.R. § 1.53(b) (Regular) or 37 C.F.R. § 1.153 (Design) Application

__11__ Pages of specification

__3__ Pages of claims

__7__ Sheets of drawing

NOTE: *"Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm. (5/8 inch) down from the top of the page . . ." 37 C.F.R. § 1.84(c)).*

(complete the following, if applicable)

☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. § 1.84(b).

☐ formal

☐ informal

B. Other Papers Enclosed

__6__ Pages of declaration and power of attorney

__1__ Pages of abstract

_____ Other

4. Additional papers enclosed

☐ Amendment to claims

  ☐ Cancel in this applications claims _____ before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)

  ☐ Add the claims shown on the attached amendment. (Claims added have been numbered consecutively following the highest numbered original claims.)

☐ Preliminary Amendment

☐ Information Disclosure Statement (37 C.F.R. § 1.98)

☐ Form PTO–1449 (PTO/SB/08A and 08B)

☐ Citations

☐ Declaration of Biological Deposit

☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.

☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative

☐ Special Comments

☐ Other

5. Declaration or oath (including power of attorney)

NOTE: A newly executed declaration is not required in a continuation or divisional application provided that the prior nonprovisional application contained a declaration as required, the application being filed is by all or fewer than all the inventors named in the prior application, there is no new matter in the application being filed, and a copy of the executed declaration filed in the prior application (showing the signature or an indication thereon that it was signed) is submitted. The copy must be accompanied by a statement requesting deletion of the names of person(s) who are not inventors of the application being filed. If the declaration in the prior application was filed under § 1.47, then a copy of that declaration must be filed accompanied by a copy of the decision granting § 1.47 status or, if a nonsigning person under § 1.47 has subsequently joined in a prior application, then a copy of the subsequently executed declaration must be filed. See 37 C.F.R. §§ 1.63(d)(1)-(3).

NOTE: A declaration filed to complete an application must be executed, identify the specification to which it is directed, identify each inventor by full name including family name and at least one given name, without abbreviation together with any other given name or initial, and the residence, post office address and country or citizenship of each inventor, and state whether the inventor is a sole or joint inventor. 37 C.F.R. § 1.63(a)(1)-(4).

☒ Enclosed

Executed by

(check all applicable boxes)

☒ inventor(s).

☐ legal representative of inventor(s).
37 C.F.R. §§ 1.42 or 1.43.

☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.

☐ This is the petition required by 37 C.F.R. § 1.47 and the statement required by 37 C.F.R. § 1.47 is also attached. *See* item 13 below for fee.

☐ Not Enclosed.

NOTE: Where the filing is a completion in the U.S. of an International Application or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

☐ Application is made by a person authorized under 37 C.F.R. § 1.41(c) on behalf of *all* the above named inventor(s).

(The declaration or oath, along with the surcharge required by 37 C.F.R. § 1.16(e) can be filed subsequently).

☐ Showing that the filing is authorized.
(not required unless called into question. 37 C.F.R. § 1.41(d))

6. Inventorship Statement

WARNING: If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.

The inventorship for all the claims in this application are:

☐ The same.

or

☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,

    ☐ is submitted.

    ☐ will be submitted.

7. Language

NOTE: An application including a signed oath or declaration may be filed in a language other than English. An English translation of the non-English language application and the processing fee of $130.00 required by 37 C.F.R. § 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 C.F.R. § 1.52(d).

☒ English

☐ Non-English

    ☐ The attached translation includes a statement that the translation is accurate. 37 C.F.R. § 1.52(d).

8. Assignment

☒ An assignment of the invention to <u>Nokia Mobile Phones Limited</u>

    ☒ is attached. A separate ☒ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

    ☐ will follow.

NOTE: "If an assignment is submitted with a new application, send two separate letters-one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).

WARNING: A newly executed "CERTIFICATE UNDER 37 C.F.R. § 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 O.G. 62-64.

9. Certified Copy

Certified copy(ies) of application(s)

Country	Appln. No.	Filed
Finland	982531	November 23, 1998
Country	Appln. No.	Filed
Country	Appln. No.	Filed

from which priority is claimed

☒ Is (are) attached.

☐ will follow.

NOTE: *The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 C.F.R. § 1.55(a) and 1.63.*

NOTE: *This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. § 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.*

10. Fee Calculation (37 C.F.R. § 1.16)

A. ☒ Regular application

CLAIMS AS FILED			
Number filed	Number Extra	Rate	Basic Fee 37 C.F.R. § 1.16(a) $760.00
Total Claims (37 C.F.R. § 1.16(c)) 9 − 20 = 0		× $ 18.00	
Independent Claims (37 C.F.R. § 1.16(b)) 1 − 3 = 0		× $ 78.00	
Multiple dependent claim(s), if any (37 C.F.R. § 1.16(d))		+ $260.00	

☐ Amendment cancelling extra claims is enclosed.

☐ Amendment deleting multiple-dependencies is enclosed.

☐ Fee for extra claims is not being paid at this time.

NOTE: *If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 C.F.R. § 1.16(d).*

Filing Fee Calculation $ 760.00

B. ☐ Design application
($310.00—37 C.F.R. § 1.16(f))

Filing Fee Calculation $_____

C. ☐ Plant application
($480.00—37 C.F.R. § 1.16(g))

Filing fee calculation $_____

11. Small Entity Statement(s)

☐ Statement(s) that this is a filing by a small entity under 37 C.F.R. § 1.9 and 1.27 is (are) attached.

WARNING: *"Status as a small entity must be specifically established in each application or patent in which the status is available and desired. Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. The refiling of an application under § 1.53 as a continuation, division, or continuation-in-part (including a continued prosecution application under § 1.53(d)), or the filing of a reissue application requires a new determination as to continued entitlement to small entity status for the continuing or reissue application. A nonprovisional application claiming benefit under 35 U.S.C. § 119(e), 120, 121, or 365(c) of a prior application, or a reissue application may rely on a statement filed in the prior application or in the patent if the nonprovisional application or the reissue application includes a reference to the statement in the prior application or in the patent or includes a copy of the statement in the prior application or in the patent and status as a small entity is still proper and desired. The payment of the small entity basic statutory filing fee will be treated as such a reference for purposes of this section." 37 C.F.R. § 1.28(a)(2).*

WARNING: *"Small entity status must not be established when the person or persons signing the . . . statement can unequivocally make the required self-certification." M.P.E.P., § 509.03, 6th ed., rev. 2, July 1996 (emphasis added).*

(complete the following, if applicable)

☐ Status as a small entity was claimed in prior application

_____ / _____, filed on _____, from which benefit is being claimed for this application under:

35 U.S.C. §   ☐   119(e),
            ☐   120,
            ☐   121,
            ☐   365(c),

and which status as a small entity is still proper and desired.

☐ A copy of the statement in the prior application is included.

Filing Fee Calculation (50% of **A, B** or **C** above)

$_____

NOTE: *Any excess of the full fee paid will be refunded if small entitiy status is established and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendable under § 1.136. 37 C.F.R. § 1.28(a).*

12. Request for International-Type Search (37 C.F.R. § 1.104(d))

(complete, if applicable)

☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made at This Time

☐ Not Enclosed

    ☐ No filing fee is to be paid at this time.
    (This and the surcharge required by 37 C.F.R. § 1.16(e) can be paid subsequently.)

☒ Enclosed

    ☒ Filing fee $ 760.00

    ☒ Recording assignment
    ($40.00; 37 C.F.R. § 1.21(h))
    (See attached "COVER SHEET FOR
    ASSIGNMENT ACCOMPANYING NEW
    APPLICATION".) $ 40.00

    ☐ Petition fee for filing by other than all the
    inventors or person on behalf of the inventor
    where inventor refused to sign or cannot be
    reached
    ($130.00; 37 C.F.R. §§ 1.47 and 1.17(i)) $ _____

    ☐ For processing an application with a
    specification in
    a non-English language
    ($130.00; 37 C.F.R. §§ 1.52(d) and 1.17(k)) $ _____

    ☐ Processing and retention fee
    ($130.00; 37 C.F.R. §§ 1.53(d) and 1.21(l)) $ _____

    ☐ Fee for international-type search report
    ($40.00; 37 C.F.R. § 1.21(e)) $ _____

NOTE: *37 C.F.R. § 1.21(l) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 C.F.R. § 1.53(f) and this, as well as the changes to 37 C.F.R. §§ 1.53 and 1.78(a)(1), indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(l) must be paid, within 1 year from notification under § 53(f).*

    Total fees enclosed $ 800.00

14. Method of Payment of Fees

☒ Check in the amount of $ 800.00

☐ Charge Account No. _____ in the amount of
    $_____.

A duplicate of this transmittal is attached.

NOTE: *Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 C.F.R. § 1.22(b).*

15. Authorization to Charge Additional Fees

WARNING: If no fees are to be paid on filing, the following items should *not* be completed.

WARNING: Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

[x] The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. __16-1350__ :

    [X] 37 C.F.R. § 1.16(a), (f) or (g) (filing fees)

    [X] 37 C.F.R. § 1.16(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

    [X] 37 C.F.R. § 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

    [X] 37 C.F.R. § 1.17(a)(1)–(5) (extension fees pursuant to § 1.136(a)).

    [ ] 37 C.F.R. § 1.17 (application processing fees)

NOTE: ". . .A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

    [ ] 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . the issue fee. . . " From the wording of 37 C.F.R. § 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

16. Instructions as to Overpayment

NOTE: "... Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

[X] Credit Account No. ____16-1350____

[ ] Refund

SEND ALL CORRESPONDENCE TO:

Reg. No. 24,622

Tel. No. (203)   259-1800
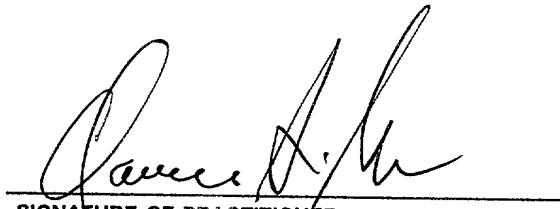
Customer No.

SIGNATURE OF PRACTITIONER

Clarence A. Green

(type or print name of attorney)

PERMAN & GREEN, LLP

P.O. Address

425 Post Road, Fairfield, Connecticut 06430

☐ **Incorporation by reference of added pages**

(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED)

☐ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added _____

☐ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added _____

☐ Plus added pages deleting names of inventor(s) named in prior application(s) who is/are no longer inventor(s) of the subject matter claimed in this application.

Number of pages added _____

☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added _____

☒ **Statement Where No Further Pages Added**

(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item)

☒ This transmittal ends with this page.

TITLE: Method and arrangement for avoiding loss of error-critical non real time data during certain handovers

TECHNOLOGICAL FIELD

5   The invention concerns generally the protocol structures that are used to arrange the communication between a mobile terminal and a packet-switched network. Especially the invention concerns the optimal composition of such structures from the point of view of minimized risk of losing certain types of data in certain handover situations on one hand and reduced complexity on the other.

10

BACKGROUND OF THE INVENTION

Fig. 1 illustrates the known data protocol stacks that are applied in a packet-switched communication connection where one end is a Mobile Station (MS) and the communication takes place over a GPRS network (General Packet Radio

15   Service) through a Base Station Subsystem (BSS), a Serving GPRS Support Node (SGSN) and a Gateway GPRS Support Node (GGSN). The protocol layers where the peer entities are in the MS and the BSS are the physical layer 101 that employs the GSM cellular radio system (Global System for Mobile telecommunications), the Media Access Control (MAC) layer 102 and the Radio Link Control layer 103

20   which sometimes is regarded as only a part of the MAC layer 102 - hence the dashed line between them. The protocol layers where the peer entities are in the BSS and the SGSN are the L1bis layer 104, the Network Service layer 105 and the BSS GPRS Protocol (BSSGP) layer 106.

The layers for which the peer entities are in the MS and the SGSN are the Logical

25   Link Control (LLC) layer 107 and the SubNetwork Dependent Convergence Protocol (SNDCP) layer 108. It should be noted that only data or user plane protocols are shown in Fig. 1; a complete illustration of protocols would include the Layer 3 Mobility Management (L3MM) and Short Message Services (SMS) blocks on top of the LLC layer 107 in parallel with the SNDCP layer 108. Additionally

30   there are the known Session Management (SM) and Radio Resource management (RR) entities that are not located on top of the LLC layer. At the interface between the SGSN and the GGSN there are the Layer 1 (L1) layer 109, the Layer 2 (L2) layer 110, a first Internet Protocol (IP) layer 111, the User Datagram Protocol /

Transport Control Protocol (UDP/TCP) layer 112 and the GPRS Tunneling Protocol (GTP) layer 113. Between the MS and the GGSN there are the X.25 layer 114 and a second Internet Protocol layer 115. An application layer 116 in the MS will communicate with a peer entity that is located for example in another MS or some

5   other terminal.

Proposals for the future UMTS (Universal Mobile Telecommunication System) have suggested similar protocol structures for the communication between mobile stations, Radio Network Controllers (RNCs) and service nodes of packet-switched networks, with small changes or modifications in the designations of the devices,

10   layers and protocols. It is typical to protocol structures like that in Fig. 1 that each layer has an exactly determined set of tasks to perform and an exactly determined interface with the next upper layer and the next lower layer. A certain amount of memory and processing power must be allocated in the devices taking part in the communication to maintain the layered structure and accomplish the tasks of each

15   layer. It is therefore easily understood that the more complicated the structure of layered protocols, the more complicated the required software and hardware implementation. Complexity is disadvantageous in terms of costs incurred in design and manufacture and it increases the possibility of design errors. Additionally, in battery-driven mobile terminals it is a continual aim to reduce power consumption

20   and diminish physical size, whereby a more simplified structure of protocol layers would create advantage.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a method and

25   arrangement that would accomplish the tasks of known communication protocol arrangements but with a simpler protocol structure.

The objects of the invention are accomplished by replacing certain parts of the protocol structure by a temporary suspension of certain communications for the duration of a handover.

30   The method according to the invention is characterised by that it comprises the steps of
- suspending at least one active non-real time telecommunication connection between a mobile station and the fixed parts of a mobile telecommunication system,

- performing a handover from a first network connection to a second network connection and

- resuming the suspended non-real time telecommunication connection.

5   The invention also concerns a mobile station arranged to perform a handover according to the above-described method.

The invention relates closely to the observation that the role of certain layers in many protocol structures is of minor practical value and is limited to certain measures for avoiding loss of data during a handover. If the data concerned allows for some additional delays to be caused on its path from the transmitting device to 10   the receiving device, such protocol layers may be omitted altogether by simply suspending the transmission of data when a handover is about to take place and resuming normal operation after the handover has been successfully completed.

In the GPRS example presented in the description of prior art the protocol layer that can be omitted by employing the suspension-resumption mechanism is the LLC 15   layer. We may note that the RLC layer is capable of performing all required error correction tasks over the radio interface in normal operation and the role of LLC has mainly been related to handovers between different BSCs (Base Station Controllers), where error-critical (but not delay-critical) data has needed a mechanism for avoiding loss of data. In the proposed UMTS a similar need has 20   existed in handovers between different RNCs or SGSNs (often designated as 3GSGSNs or 3rd Generation SGSNs). If we remove this need by temporarily suspending the transmission of such error-critical data altogether for the duration of that time interval where loss of data could otherwise occur, the error-correcting functions of the LLC layer become superfluous.

25   The LLC layer has also had certain responsibilities for flow control. According to the invention the RLC layer may take care of all flow control between the mobile station and a base station controller or a radio network controller (or generally the radio access network), and local flow control mechanisms may be employed for controlling the flow over the interface between the radio access network and a core 30   network. In UMTS the latter is known as the Iu interface.

BRIEF DESCRIPTION OF DRAWINGS

The novel features which are considered as characteristic of the invention are set forth in particular in the appended Claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

Fig. 1   illustrates the known protocol stacks in a GPRS implementation,

Fig. 2   illustrates the known functional model of an LLC layer,

Fig. 3   illustrates a functional model that would replace the LLC layer according to the invention,

Fig. 4   illustrates an arrangement of protocol stacks according to the invention,

Figs. 5a to 5c illustrate an inter-RNC, intra-SGSN handover according to the invention,

Figs. 6a to 6c illustrate an inter-RNC, inter-SGSN handover according to the invention and

Figs. 7a and 7b show a comparison between a prior art method and a method according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

We will illustrate the applicability of the invention in connection with the known GPRS system. However, the presented examplary embodiments do not limit the applicability of the invention to any specific system. As a background to the invention we will first consider some known characteristics of the GPRS system.

The general packet radio service (GPRS) is a new service to the GSM system, and is one of the objects of the standardization work of the GSM phase 2+ at the ETSI (European Telecommunications Standards Institute). The GPRS operational environment comprises one or more subnetwork service areas, which are inter-connected by a GPRS backbone network. A subnetwork comprises a number of packet data service nodes (SN), which in this application will be referred to as serving GPRS support nodes (SGSN), each of which is connected to the mobile

telecommunications system in such a way that it can provide a packet service for mobile data terminals via several base stations, i.e. cells. The intermediate mobile communication network provides packet-switched data transmission between a support node and mobile data terminals. Different subnetworks are in turn

5   connected to an external data network, e.g. to a public switched data network (PSDN), via GPRS gateway support nodes (GGSN). The GPRS service thus allows to provide packet data transmission between mobile data terminals and external data networks when the appropriate parts of a mobile telecommunications system function as an access network.

10 In order to access the GPRS services, a MS shall first make its presence known to the network by performing a GPRS attach. This operation makes the MS available for SMS (Short Message Services) over GPRS, paging via SGSN, and notification of incoming GPRS data. More particularly, when the MS attaches to the GPRS network, i.e. in a GPRS attach procedure, the SGSN creates a mobility management

15 context (MM context). Also the authentication of the user is carried out by the SGSN in the GPRS attach procedure. In order to send and receive GPRS data, the MS shall activate the packet data address that it wants to use, by requesting a PDP context activation procedure, where PDP comes from Packet Data Protocol. This operation makes the MS known in the corresponding GGSN, and interworking with

20 external data networks can commence. More particularly a PDP context is created in the MS and the GGSN and the SGSN. The PDP context defines different data transmission parameters, such as the PDP type (e.g. X.25 or IP), PDP address (e.g. X.121 address), quality of service (QoS) and NSAPI (Network Service Access Point Identifier). The MS activates the PDP context with a specific message, Activate

25 PDP Context Request, in which it gives information on the TLLI, PDP type, PDP address, required QoS and NSAPI, and optionally the access point name (APN).

The quality of service defines how the packet data units (PDUs) are handled during the transmission through the GPRS network. For example, the quality of service levels defined for the PDP addresses control the order of transmission, buffering

30 (the PDU queues) and discarding of the PDUs in the SGSN and the GGSN, especially in a congestion situation. Therefore, different quality of service levels will present different end-to-end delays, bit rates and numbers of lost PDUs, for example, for the end users.

Currently the GPRS allows for only one QoS for each PDP context. Typically a

35 terminal has only one IP address, so conventionally it may request for only one PDP context. There is recognised the need for modifying the existing systems so that a

PDP context could accommodate several different QoS flows. For example, some flows may be associated with E-mail that can tolerate lengthy response times. Other applications cannot tolerate delay and demand a very high level of throughput, interactive applications being one example. These different requirements are
5   reflected in the QoS. Intolerance to delay must usually be associated with a relatively good tolerance for errors; correspondingly a very error-critical application must allow for long delays, because it is impossible to predict how many retransmission attempts it will take to achieve the required high level of correctness. If a QoS requirement is beyond the capabilities of a PLMN, the PLMN negotiates the
10   QoS as close as possible to the requested QoS. The MS either accepts the negotiated QoS, or deactivates the PDP context.

Current GPRS QoS profile contains five parameters: service precedence, delay class, reliability, and mean and peak bit rates. Service precedence defines some kind of priority for the packets belonging to a certain PDP context. Delay class defines
15   mean and maximum delays for the transfer of each data packet belonging to that context. Reliability in turn specifies whether acknowledged or unacknowledged services will be used at LLC (Logical Link Control) and RLC (Radio Link Control) layers. In addition, it specifies whether protected mode should be used in case of unacknowledged service, and whether the GPRS backbone should use TCP or UDP
20   to transfer data packets belonging to the PDP context. Furthermore, these varying QoS parameters are mapped to four QoS levels available at the LLC layer.

Fig. 2 is a functional model of a known LLC protocol layer 201, corresponding to the blocks 107 in Fig. 1. Block 202 represents the known lower layer (RLC/MAC; Radio Link Control / Media Access Control) functions that are located below the
25   LLC layer 201 in the protocol stack of a mobile station MS. Correspondingly block 203 represents the known lower layer (BSSGP) functions that are located below the LLC layer 201 in a serving GPRS support node SGSN. The interface between the LLC layer 201 and the RLC/MAC layers 202 is called the RR interface and the interface between the LLC layer 201 and the BSSGP layers 203 is called the BSSGP
30   interface.

Above the LLC layer there are the known GPRS Mobility Management functions 204 (also known as the Layer 3 Mobility Management functions or L3MM), SNDCP functions 205 and Short Messages Services functions 206. Each one of these blocks has one or more interfaces with the LLC layer 201, connecting to its
35   different parts. The Logical Link Management Entity 207 has an LLGMM control interface (Logical Link - GPRS Mobility Management) with block 204. Mobility

management data is routed through a LLGMM data interface between block 204 and the first Logical Link Entity 208 of the LLC layer. The second 209, third 210, fourth 211 and fifth 212 Logical Link Entities connect to block 205 through the corresponding interfaces; according to the QoS levels handled by each of the

5   Logical Link Entities the interfaces are known as QoS 1, QoS 2, QoS 3 and QoS 4. The sixth Logical Link Entity 213 of the LLC layer connects to block 206 via an LLSMS interface (Logical Link - Short Messages Services). The Service Access Point Identifiers or SAPIs of the first 208, second 209, third 210, fourth 211, fifth 212 and sixth 213 Logical Link Entities are respectively 1, 3, 5, 9, 11 and 7. Each

10   one of them is connected inside the LLC layer to a multiplexing block 214, which handles the connections through the RR interface to block 202 and further towards the mobile station as well as the connections through the BSSGP interface to block 203 and further towards the SGSN. The connection between the multiplexing block 214 and the lower layer block 202 in the direction of the MS may be described as a

15   "transmission pipe".

Fig. 3 illustrates an arrangement according to the invention where the LLC layer has been completely omitted. The upper layers comprise a MM/RR part 301 for known mobility and radio resource management, an SMS part 303 for processing data related to short messages, as well as a part 302' for processing the received data and

20   data to be transmitted according to other functionalities. "Local" multiplexing/-demultiplexing is performed at the upper layers in blocks 304 to 308 so that there is only one transmission pipe for control information between the MM/RR part 301 and the lower layers, one transmission pipe for SMS-related information between the SMS part 303 and the lower layers, and one transmission pipe for each quality of

25   service class between the other functionalities part 302 and the lower layers. Multiplexing is shown in Fig. 3 as taking place in separate functional blocks; however, it may be an inherent part of for example one or several functionalities in the other functionalities part 302.

The RLC/MAC layer is located directly under the upper layers in Fig. 3. It performs

30   the known RLC/MAC functions for each flow of information for which there is a connection between it and the upper layers. The MAC functions consist of procedures for sharing the common radio channels between mobile stations as well as allocations and disallocations of dedicated radio channels. The RLC functions comprise the composing and decomposing of RLC blocks, detecting corrupted RLC

35   blocks and arranging for the retransmission of corrupted blocks when appropriate. In UMTS the the concept of an RLC unit is unidirectional and reserved for one

information flow only, so the widely interpreted RLC layer in the protocol structure will accommodate a pair of RLC units for each active flow of information. The multiplexing and demultplexing of the RLC blocks belonging to different flows of information takes place on the physical layer, which is represented by block 315 in
5   Fig. 3. In a spread spectrum system it is advantageous to multiplex all flows of information related to a certain mobile terminal onto a single code channel. From the published standardisation work of the UMTS there is known a physical layer that is applicable to perform the operations represented by block 315.

Fig. 3 as such is only applicable to the mobile station, because there is an RLC /
10   MAC layer under the higher-order layers. However, it is easy to generalise the arrangement of Fig. 3 so that there may be a BSSGP layer under the higher-order layers, resulting in an arrangement applicable to a SGSN. Also in that case there must be an additional stage of multiplexing/demultiplexing at the physical level, like block 315 in Fig. 3.

15   Fig. 4 illustrates the inventive structure of protocol stacks which is comparable to the known arrangement of Fig. 1. It is noted that there is no LLC layers in the mobile station or the SGSN, the physical layer between the mobile station and the RAN has been replaced by a UMTS physical layer 401, the BSSGP layer between the RAN and the SGSN has been replaced by a corresponding UMTS layer
20   preliminarily known as the RANGP (RAN GPRS Protocol) layer 402, and the MAC, RLC, SNDCP, Network Service and L1bis layers have been adapted according to the guidelines given above in association with Fig. 3.

Next we will describe some handover situations where a mobile station and the network will apply the principle of temporarily suspending error-critical
25   communications according to the invention. Fig. 5a illustrates a situation where the mobile station 501 has a macrodiversity connection with two RNCs (Radio Network Controllers) network so that the first RNC 502 is the so-called serving RNC and the second RNC 503 is the so-called drifting RNC. The interface between the two RNCs is called the Iur interface. From the serving RNC 502 there is a connection to
30   a SGSN 504 over a so-called Iu interface, and from the SGSN there is a connection to a GGSN 505. A generalisation of the arrangement of Fig. 5a is the case where the second RNC is just a "new" serving RNC regardless of whether it was firstly a drifting RNC or not. Drifting RNCs relate only to macrodiversity; if no macro-diversity is applied there will be an "old" serving RNC and a "new" serving RNC
35   (or, in second generation systems, an "old" BSS and a "new" BSS) with little simultaneous service from both of them to the mobile station.

In Fig. 5b either the mobile station 501 or some network device in the radio access network (not shown) where the serving RNC 502 is located notices that the direct connection between the mobile station and the serving RNC is critically weakening or has been severed, so a handover to the second RNC 503 is inevitable. According to the invention, the handover is started by requesting all such active services to be suspended which require a high level of correctness and tolerate long delays. In a GPRS type arrangement the suspension of services would require suspending whole PDP contexts, because the PDP context can only have one QoS. In a UMTS type arrangement it suffices to suspends those QoS flows for which the QoS allows for (delay tolerance) and even requires (correctness) the suspension. To retain generality we will use the word "service" for the entities that will be suspended. It will be most advantageous to define beforehand, in a standardised specification, a threshold value either for required correctness or for allowed delays or for both so that only those active services will be suspended for which the required correctness or allowed delay or both exceed the threshold value(s).

After the suspension of the selected active services the network will establish a new connection over the Iu interface between the second RNC 503 and the SGSN 504. Simultaneously communication on the non-suspended services may continue. Typically there will be some RLC level buffers in at least one of the devices taking part in the communication that need to be emptied before the second RNC may be designated as the serving RNC. The situation illustrated in Fig. 5c may only become relevant after all such RLC buffers have been emptied and the new connection over the Iu interface between the second RNC and the SGSN has been established. At that moment the suspended services may be released so that communication over them will continue normally. In Fig. 5c the second RNC 503 is the serving RNC and the old connection over the Iu interface between the first RNC 502 and the SGSN 504 has been terminated.

In Fig. 5c it has been assumed that the handover was not associated with a complete severance of the direct connections between the mobile station 501 and the first RNC 502. Consequently the connection over the Iur interface between the RNCs is not terminated and the first RNC continues to operate as a drifting RNC. Sooner or later, especially if the mobile station continues the movement that caused the direct connections to the first RNC to weaken, these direct connections will fall under the level of acceptable quality so that they are completely released and the connection over the Iur interface between the RNCs is terminated.

Figs 6a to 6c describe a handover situation where the new RNC operates under a new SGSN. Such a handover is called an inter-RNC, inter-SGSN handover. Here we have expected that an Iur interface exists even between RNCs that operate under different SGSNs; this is not a requirement associated with the invention, because the
5   invention works equally well without any connections between the RNCs. Fig. 6a corresponds to Fig. 5a with the sole exception that the second RNC 601 belongs to the domain of a second SGSN 602. At some stage it is again noticed that a handover from the first RNC to the second RNC will be required. The operation starts with the suspension of error-critical, delay-tolerant PDP contexts as described above.
10   According to Fig. 6b, the controlling responsibility remains in the first RNC 502 and the first SGSN 504 during the time it takes the mobile station to registrate under the second SGSN 602 and the latter to set up a new GTP bearer with the GGSN 505. The first SGSN 504 will also transmit all information related to the connections to be transferred to the second SGSN 602, as illustrated by an arrow in Fig. 6b.
15   Thereafter the controlling responsibilities may be moved to the second RNC 601 and the second SGSN 602 as illustrated in Fig. 6c, and the suspended PDP contexts may be resumed. If there are still usable direct connections between the mobile station and the first RNC 502 and a working Iur interface between the RNCs, the first RNC may remain as a drifting RNC.

20   It is possible that the new SGSN is not capable of handling some information flows the controlling responsibility of which it has received during the handover. Special measures which are as such outside the scope of the present invention may be taken in order to adapt the information flows to the capabilities of the new SGSN. After all information flows are in such shape that the new SGSN is capable of handling
25   them, the connection between the mobile terminal and the old SGSN may be terminated.

Figs. 7a and 7b are simplified flow diagrams that show an important difference between a prior art method (Fig. 7a) and a method according to the invention (Fig. 7b) when handovers are concerned. In Fig. 7a all QoS flows are active throughout
30   the handover, and LLC layer routines are employed to correct any errors that the handover causes to the error-critical, delay-tolerant QoS flows. In Fig. 7b a step 704 of suspending the selected error-critical, delay-tolerant QoS flows precedes the handover, no LLC layer routines are performed, and a step 705 of resuming the error-critical, delay-tolerant QoS flows follows the handover.

35   A comparison between Figs. 1 and 4, with the help of Figs. 2 and 3, may be used to describe a mobile station and an SGSN according to the invention. It is known as

such that the advantageous implementation of the protocol stacks in mobile stations and SGSNs is in the form of microprocessor-executable computer programs stored in memory devices. By applying the teachings of the present patent application it is within the capabilities of a person skilled in the art to realise, instead of the protocol structures illustrated in Figs. 1 and 2, the protocol structures according to Figs. 3 and 4 so that the mobile stations and SGSNs with such an implementation will operate according to the present invention.

The invention has been desribed above solely with reference to packet-switched non-real time communication connections. However, it is possible to apply the concept of suspending and releasing also to specific kinds of circuit-switched connections. The prerequisite for applying the invention to circuit-switched connections is that such connections must have very relaxed delay requirements; in the terminology of second generation digital cellular radio systems the invention is applicable to non-transparent circuit-switched connections but not to transparent circuit-switched connections because of the tight delay requirements associated therewith.

CLAIMS

1.   A method for a mobile station for performing a handover from a first network connection to a second network connection in a mobile telecommunication system providing for non-real time telecommunication connections over a radio interface
5   between mobile stations and the fixed parts of the mobile telecommunication system, comprising the steps of
- suspending at least one active non-real time telecommunication connection between a mobile station and the fixed parts of the mobile telecommunication system,
10   - performing a handover from the first network connection to the second network connection and
- resuming the suspended non-real time telecommunication connection.

2.   A method according to claim 1, wherein the first network connection is a connection from the mobile station via a first radio network controller to a first
15   serving node of a packet-switched data transmission network and the second network connection is a connection from the mobile station via a second radio network controller to said first serving node, whereby the step of performing a handover comprises the substeps of
- exhausting through the first network connection all transmission buffers that, at the
20   time of suspending said at least one active non-real time telecommunication connection, contain data to be transmitted over the first network connection and
- establishing the logical connections between the mobile station and said first serving node via said second radio network controller that constitute the second network connection.

25   3.   A method according to claim 2, wherein
- the first network connection is a macrodiversity connection comprising a direct connection between the mobile station and said first radio network controller and an indirect connection between the mobile station and said first radio network controller via said second radio network controller and
30   - the second network connection is a macrodiversity connection comprising a direct connection between the mobile station and said second radio network controller and an indirect connection between the mobile station and said second radio network controller via said first radio network controller,
whereby the step of performing a handover comprises additionally the substep of
35   changing the macrodiversity control from the first radio network controller to the second radio network controller.

4. A method according to claim 1, wherein the first network connection is a connection from the mobile station via a first radio network controller to a first serving node of a packet-switched data transmission network and the second network connection is a connection from the mobile station via a second radio
5 network controller to a second serving node of said packet-switched data transmission network, whereby the step of performing a handover comprises the substeps of
- exhausting through the first network connection all transmission buffers that, at the time of suspending said at least one active non-real time telecommunication
10 connection, contain data to be transmitted over the first network connection and
- establishing the logical connections between the mobile station and said second serving node via said second radio network controller that constitute the second network connection.

5. A method according to claim 1, wherein the non-real time telecommunication
15 connections are arranged according to a certain structure of protocol stacks in a mobile station, a radio access network, a serving support node of a packet-switched data transfer network and a gateway support node of a packet-switched data transfer network, and the method comprises the steps of
- communicating between a number of first peer entities between the mobile station
20 and the radio access network, wherein said first peer entities are composed of a physical layer, a Media Access Control layer and a Radio Link Control layer,
- communicating between a number of second peer entities between the radio access network and the serving support node of a packet-switched data transfer network, wherein said second peer entities are composed of a physical layer, a Network
25 Service layer and a protocol layer for communication between the radio access network and the packet-switched data transfer network, and
- communicating between a number of third peer entities between the mobile station and the serving support node of a packet-switched data transfer network, wherein said third peer entities are composed of a Subnetwork Dependent Control Protocol
30 Layer which in the mobile station is immediately on top of the Radio Link Control layer and in the serving support node of a packet-switched data transfer network is immediately on top of the protocol layer for communication between the radio access network and the packet-switched data transfer network.

6. A method according to claim 5, additionally comprising the steps of
35 performing error detection and error-related retransmission as well as flow control

between the mobile station and the radio access network on said Radio Link Control layer.

7.   A method according to claim 1, wherein the first network connection and the second network connection are packet-switched connections for transmitting error-critical data.

8.   A method according to claim 1, wherein the first network connection and the second network connection are non-transparent circuit-switched connections.

9.   A mobile station for communicating with the fixed parts of a mobile tele-communication system over network connections, comprising means for executing the method according to claim 1 in order to perform a handover from a first network connection to a second network connection.

Abstract

A method is disclosed for a mobile station for performing a handover from a first network connection to a second network connection. A mobile telecommunication system provides for non-real time telecommunication connections over a radio interface between mobile stations and the fixed parts of the mobile telecommunication system. At least one active non-real time telecommunication connection is between a mobile station and the fixed parts of the mobile telecommunication system is suspended (704) before performing a handover (702') from the first network connection to the second network connection. After the new connection has been established the suspended non-real time telecommunication connection are resumed (705).

Fig. 7b
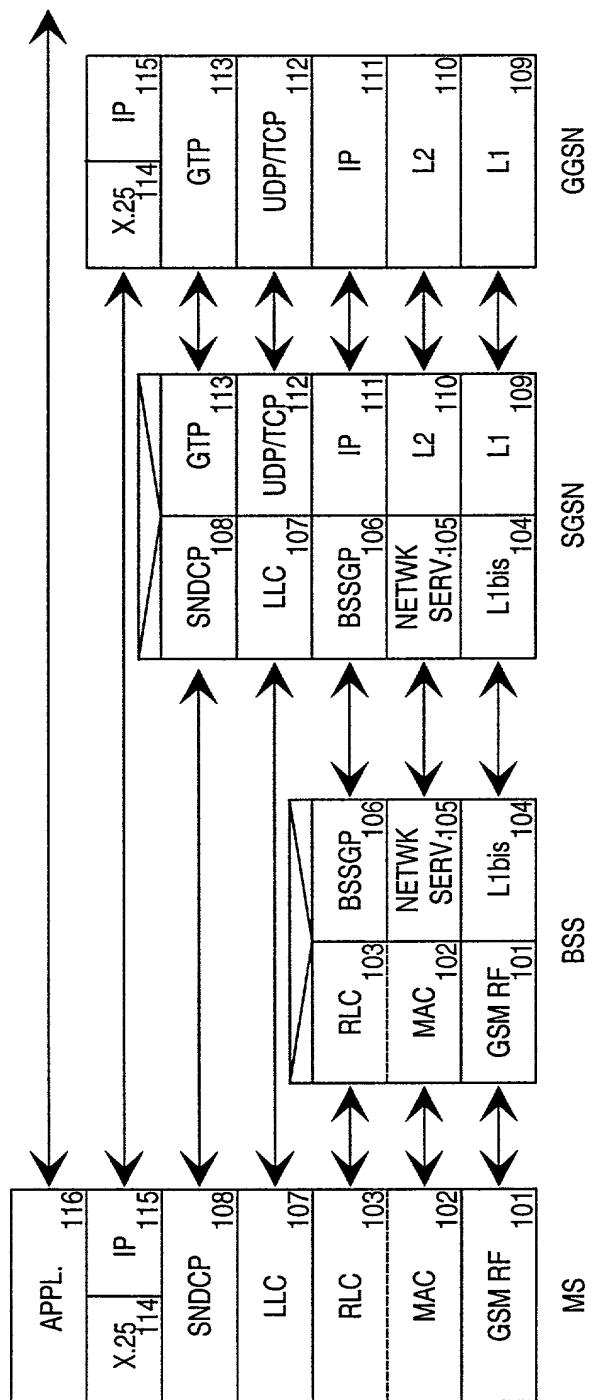
Fig. 1
PRIOR ART

Fig. 2
PRIOR ART

Fig. 3

UPPER LAYERS

RLC / MAC LAYER

PHYSICAL LAYER

GPRS MOBILITY MANAGEMENT
RADIO RESOURCE MANAGEMENT

301

OTHER FUNCTIONALITIES

302

303 SMS

304 MULTIPLEXING

305 MULTIPLEXING

306 MULTIPLEXING

307 MULTIPLEXING

308 MULTIPLEXING

MM, RR

QoS 1

QoS 2

QoS 3

QoS 4

SMS

309 RLC / MAC PROCEDURES

310 RLC / MAC PROCEDURES

311 RLC / MAC PROCEDURES

312 RLC / MAC PROCEDURES

313 RLC / MAC PROCEDURES

314 RLC / MAC PROCEDURES

MULTIPLEXING, PREFERABLY ONTO SINGLE CODE CHANNEL (IN CDMA)

315
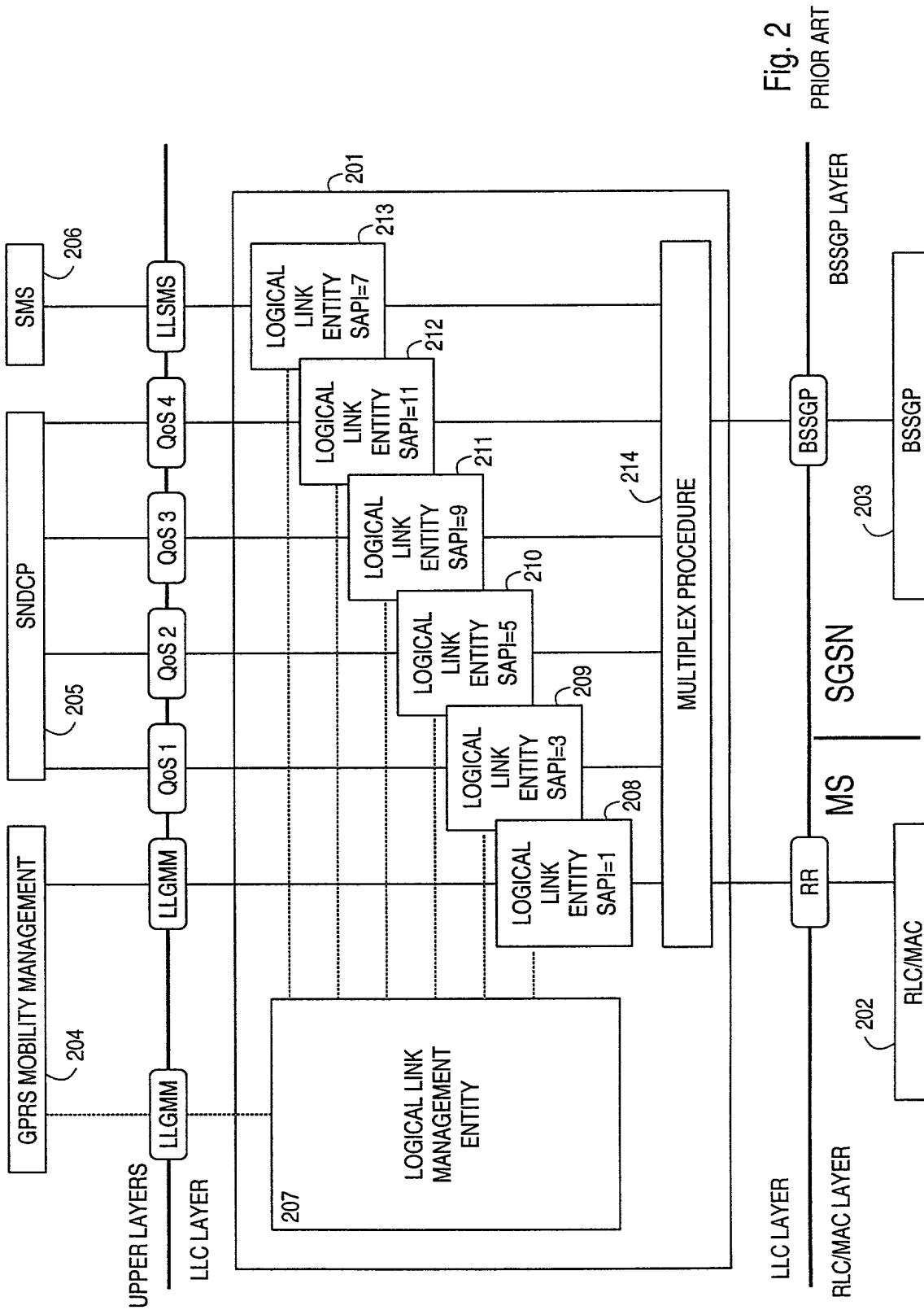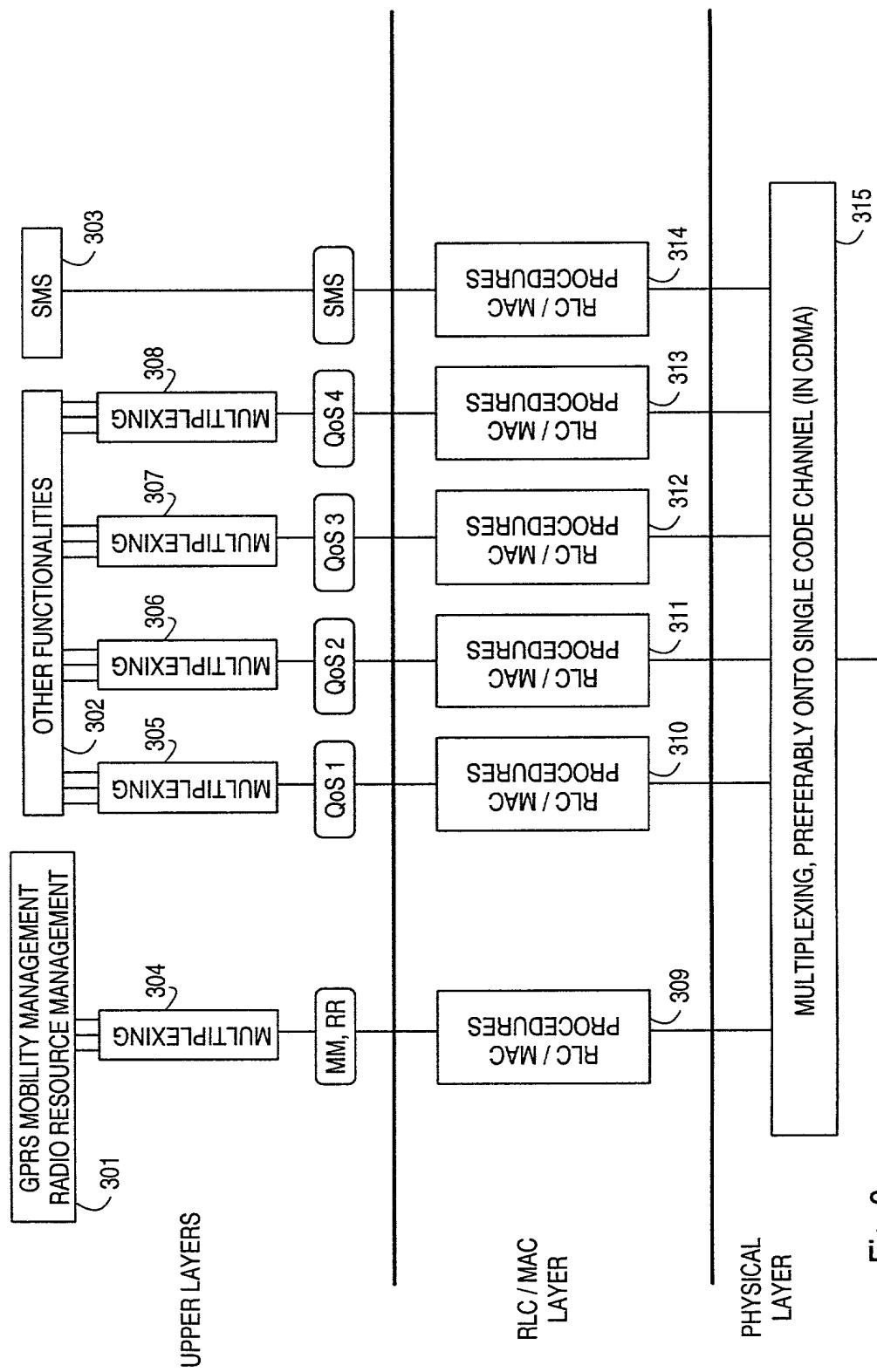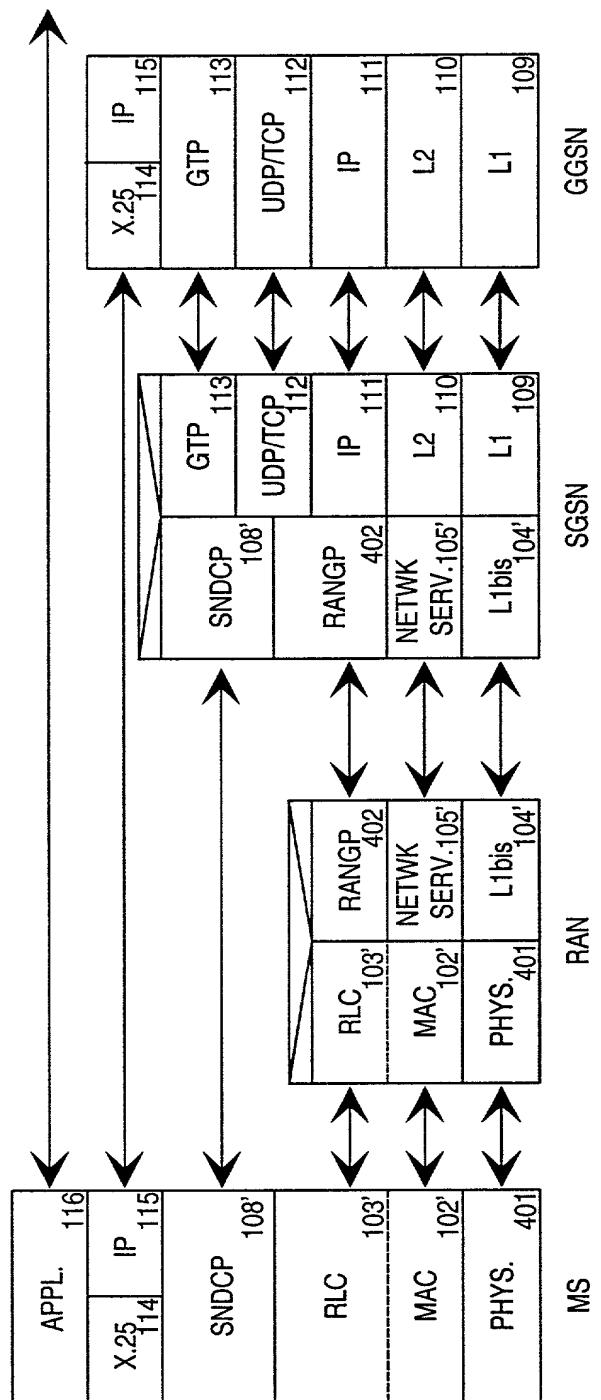
Fig. 4

Fig. 5a
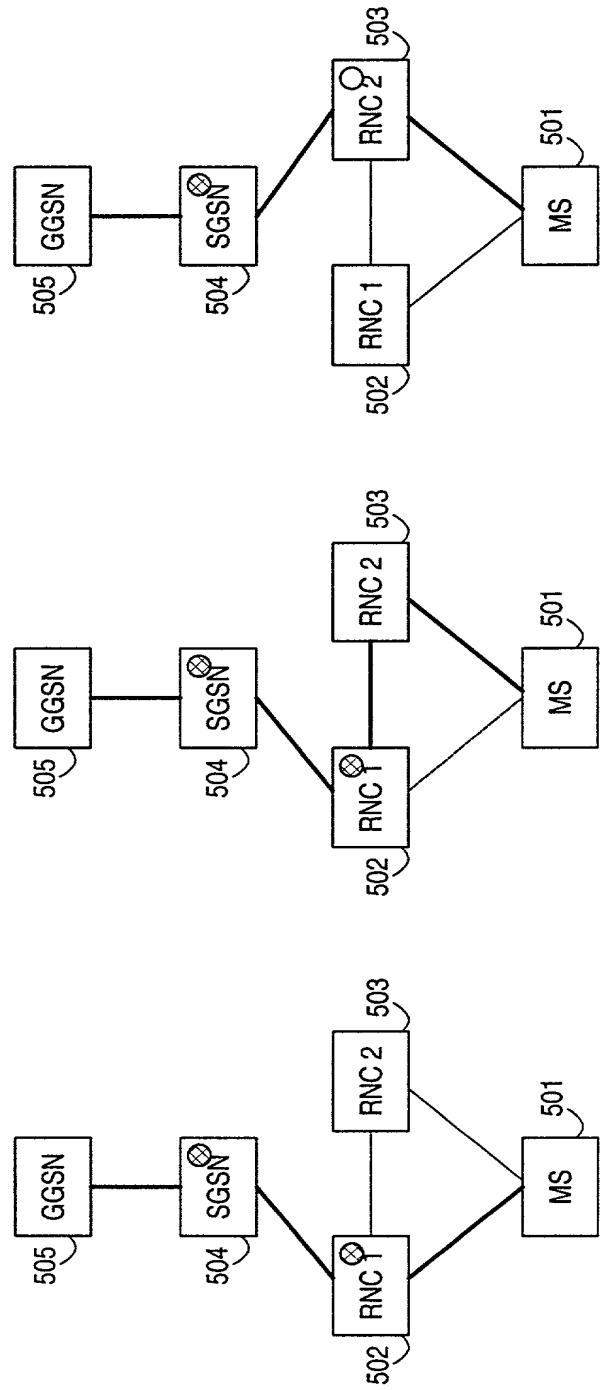
Fig. 5b

Fig. 5c

⊗ CONTROL
○ NEW CONTROL
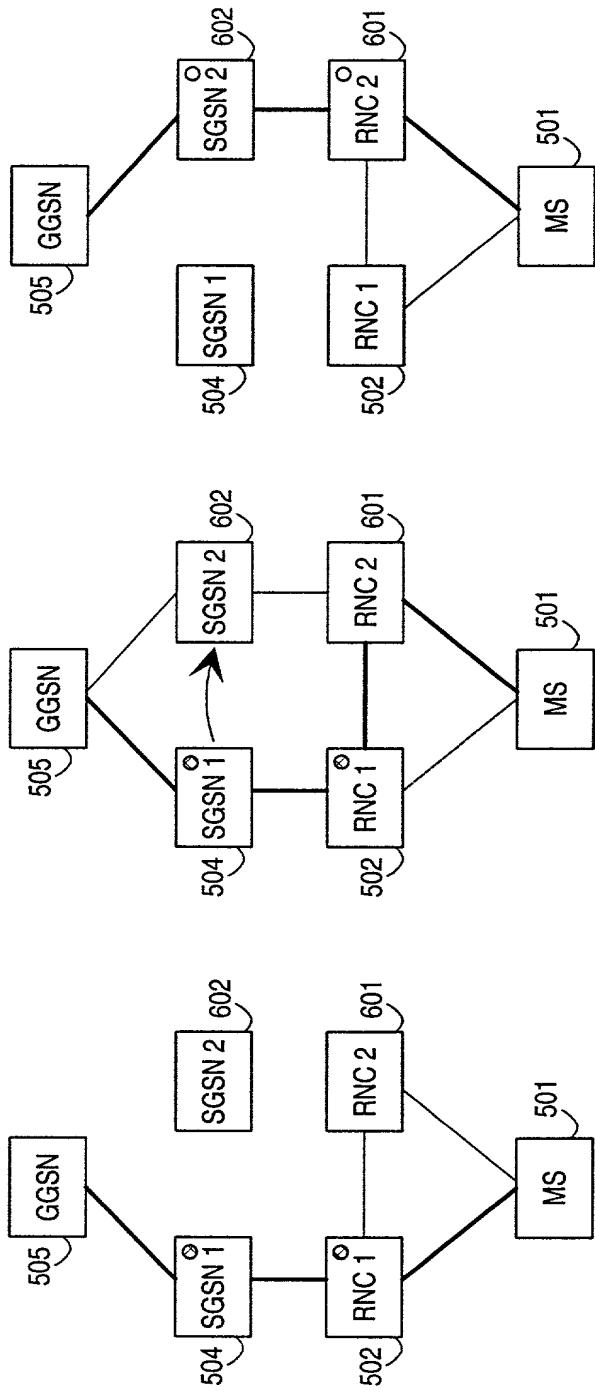
Fig. 6a

Fig. 6b

Fig. 6c

⊗ CONTROL

○ NEW CONTROL

START HANDOVER — 701

SUSPEND SELECTED QoS FLOWS — 704

PERFORM HANDOVER, NO LLC ROUTINES — 702'

RESUME SUSPENDED QoS FLOWS — 705

HANDOVER COMPLETE — 703

Fig. 7b

START HANDOVER — 701

PERFORM HANDOVER, USE LLC ROUTINES TO ENSURE CORRECTNESS — 702

HANDOVER COMPLETE — 703
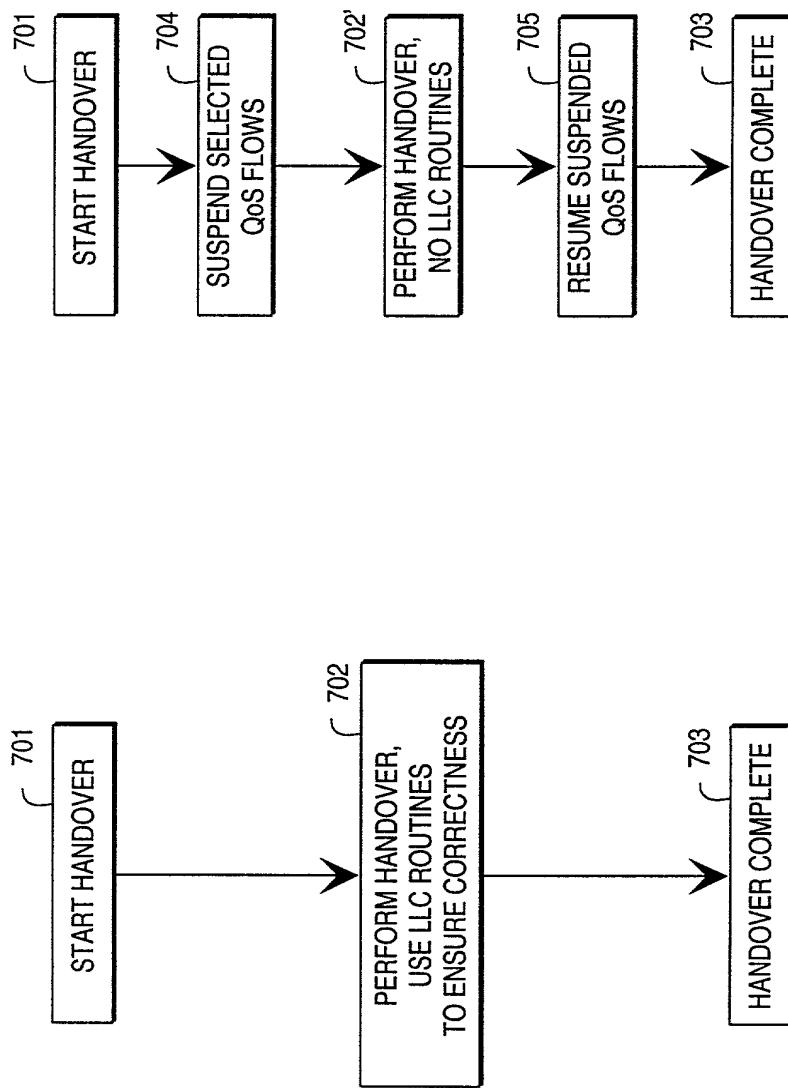
Fig. 7a

COMBINED DECLARATION AND POWER OF ATTORNEY
(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL, CONTINUATION OR C-I-P)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:

(check one applicable item below)

  X original.
  __ design.
  __ supplemental.

NOTE. If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.

  __ national stage of PCT.

NOTE: If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR C-I-P.

  __ divisional.
  __ continuation.
  __ continuation-in-part (C-I-P).

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor *(if only one name is listed below)* or an original, first and joint inventor *(if plural names are listed below)* of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

Method and arrangement for avoiding loss of error-critical non real time data during certain handovers

SPECIFICATION IDENTIFICATION

the specification of which:

(complete (a), (b) or (c))

(a) _X_ is attached hereto.

(b) __ was filed on_____, as __ Serial No._____

  or __ Express Mail No., as Serial No. not yet known _____

  and was amended on_____*(if applicable)*.

NOTE. Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.

(c) __ was described and claimed in PCT International Application No._____,

  filed on _____ and as amended under PCT Article 19 on

  _____ *(if any)*.

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

(also check the following items, if desired)

 _X_ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

 _X_ in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 CFR 1.98.

PRIORITY CLAIM (35 U.S.C. § 119(a)-(d))

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

(d) __ no such applications have been filed.

(e) _X_ such applications have been filed as follows.

NOTE. Where item (c) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS
(6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)

COUNTRY(OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
FINLAND	982531	23 November 1998	_X_ YES NO__
			__YES NO__
			__YES NO__
			__YES NO__
			__YES NO__

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(34 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER   FILING DATE

_____/_____   _____

_____/_____   _____

_____/_____   _____

CLAIM FOR BENEFIT OF EARLIER US/PCT APPLICATION(S)
UNDER 35 U.S.C. 120

__ The claim for the benefit of any such applications are set forth in the attached ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN PART (C-I-P) APPLICATION.

ALL FOREIGN APPLICATION(S), *IF ANY*, FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

_____

_____

_____

NOTE. If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage, or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR C-I-P APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. § 120.

POWER OF ATTORNEY

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

(list name and registration number)

Clarence A. Green	(24,622)
Harry F. Smith	(32,493)
Mark F. Harrington	(31,686)

(check the following item, if applicable)

___ Attached, as part of this declaration and power of attorney, is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO

Clarence A. Green
Perman & Green
425 Post Road
Fairfield, Ct 06430

DIRECT TELEPHONE CALLS TO:
*(Name and telephone number)*

Clarence A. Green
203-259-1800

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such wilful false statements may jeopardize the validity of the application or any patent issued thereon.

(Declaration and Power of Attorney [1-1]-page 4 of 6)

SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other documents.

Full name of sole or first inventor:

Given name: Juha
Middle initial or name:
Family (or last name):   KALLIOKULJU
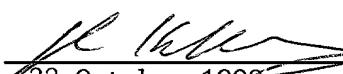
Inventor's signature:
Date: 22 October 1999
Country of Citizenship: Finland
Residence: Jokioistentie 5, FIN-37470 VESILAHTI, Finland
Post Office Address: Jokioistentie 5, FIN-37470 VESILAHTI, Finland

Full name of second joint inventor, if any:

Given name: Matti
Middle initial or name:
Family (or last name):   TURUNEN
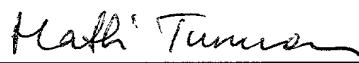
Inventor's signature:
Date: 22 October 1999
Country of Citizenship: Finland
Residence: ~~Kirkkoladunkatu 28 B 7~~, FIN-33560 TAMPERE, Finland
Post Office Address: ~~Kirkkoladunkatu 28 B 7~~, FIN-33560 TAMPERE, Finland

Kirkkoladonkatu 28 B 7, FIN-33560 TAMPERE, Finland

Full name of third joint inventor, if any:

Given name: Jan
Middle initial or name:
Family (or last name):   SUUMÄKI
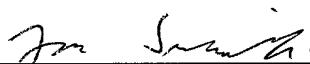
Inventor's signature:
Date: 22 October 1999
Country of Citizenship: Finland
Residence: ~~Satamakatu 1 C 61, FIN-33200 TAMPERE, Finland~~
Post Office Address: ~~Satamakatu 1 C 61, FIN-33200 TAMPERE, Finland~~

Teekkarinkatu 5 A 23, FIN-33720 TAMPERE, Finland

Full name of fourth joint inventor, if any:

Given name:
Middle initial or name:
Family (or last name):

Inventor's signature:
Date:
Country of Citizenship:
Residence:
Post Office Address:

*(check proper box(es) for any of the following added page(s)
that form a part of this declaration)*

___**Signature** for fifth and subsequent joint inventors. *Number of pages added _____.*

* * *

___ **Signature** by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor. *Number of pages added _____.*

* * *

___ **Signature** for inventor who refuses to sign or cannot be reached by person authorized under 37 CFR 1.47. *Number of pages added _____.*

* * *

___ Added page for **signature** by one joint inventor on behalf of deceased inventor(s) where legal representative cannot be appointed in time. (37 CFR 1.47)

* * *

___ Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (C-I-P) application.
                    ___ Number of pages added_____

* * *

___ Authorization of attorney(s) to accept and follow instructions from representative.

* * *

*(if no further pages form a part of this Declaration,
then end this Declaration with this page and check the following item)*
 X This declaration ends with this page.